Appendix E

Entomology Specialist Report

Resource: Entomology

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On September 16, 2002, I visited the Little Canyon Mountain (LCM) area with Robert Vidourek, forester from the Prineville District of the Bureau of Land Management. The purpose of my visit was to examine the stands on Little Canyon Mountain and to evaluate some of the recent tree mortality that has occurred there.

We visited two stands on the north slope of Little Canyon Mountain where recent ponderosa pine mortality was fairly concentrated. My observations and our discussions from this site visit are presented in the format required for the Little Canyon Mountain Fuels Reduction Environmental Assessment.

Past Management actions in the area

There have not been any actions taken that mitigate the presence of insects or pathogens in the area.

Brief Existing Environment/Condition

The LCM stands are experiencing significant tree mortality in the ponderosa pine component due to a complex of four bark beetle species (pine engraver, red turpentine beetle, western pine beetle, mountain pine beetle). Most of this mortality has been very recent, within the last two to three years, and beetle populations are increasing. Many residual pine trees are only carrying the most recent year's foliage in their crowns and do not appear to be in a sufficiently healthy condition to withstand the increase in bark beetles that is occurring. As such, an increase in tree mortality is expected to continue in these stands if the basal areas are not reduced and if drought conditions continue to prevail.

Detailed Existing Environment/Condition – BLM Lands

The stands of ponderosa pine and Douglas-fir on the lower fringe of the north face of Little Canyon Mountain are less than 140 years old and appear to have originated through natural encroachment from the higher elevations. The pines are of various sizes including some that are large (over 20" dbh). Douglas-firs are generally smaller and less abundant that the ponderosa pines in the stands we visited. There has been limited harvest entry, with some overstory removals occurring in the 1960s. The residual stands are fairly dense and are probably well above the long-term carrying capacity of the site.

Many of the crowns of the ponderosa pines only contain the most recent year's needles, a condition that could be the result of one or more factors: the recent drought in the area, a possible needle cast disease, and genetics.

A number of ponderosa pines of all sizes have died within the past two to three years. In addition, many other trees have dead tops with some live branches below. We found evidence of four bark beetle species in these stands, including the pine engraver (*Ips pini*), the red turpentine beetle (*Dendroctonus valens*), the western pine beetle (*D. brevicomis*) and the mountain pine beetle (*D. ponderosae*). The pine engraver was the most common bark beetle that we saw and is the most likely contributor to the top-kill in ponderosa pine. Even though the pine engraver is generally found in smaller diameter host material, we found cases in the LCM stands where these bark beetles had infested the boles of larger trees (16-22" dbh) and had killed them. The red turpentine beetle was always present in trees infested by *Ips pini*, easily recognized by the large pitch tubes at the base of the tree. Most of these pitch tubes were very fresh and some contained live turpentine beetles indicating that the attacks had occurred this year, probably in response to the weakening of the trees by engraver attacks from the previous year. A very common condition that we observed in ponderosa pine was extensive top-kill, with few live green branches below, heavy turpentine beetle attack at the base, but little presence of bark beetles at midbole. These trees are presently alive but will be very likely to die next year or the year following, due to the heavy damage they have already sustained and due to very little viable crown remaining. A few trees had been infested and killed by the western pine beetle, but these were less common than the trees with severe top-kill from the pine engraver. The mountain pine beetle was only found in one tree that had been killed by western pine beetle.

We found evidence of trees infested and killed by bark beetles this year, but still retaining a green crown that will not discolor until next year. (The fact that the crowns of beetle-killed trees do not discolor until nearly a year after they are dead will provide a significant challenge during the marking process when trees are selected to be left after the treatment).

Detailed Existing Environment/Condition – Adjoining Lands

We did not examine adjoining lands in this site visit, but it is likely that the pine forests are also experiencing some tree mortality due to the dry conditions we have had in recent years. There has been a significant upward trend in pine mortality throughout the forests east of the Cascades in the past two or three years.

Reasonably foreseeable management actions in the area not including the LCM Project

Some adjoining land managers may choose to treat overly dense stands of ponderosa pine in order to limit their vulnerability to bark beetles. The treatments may likely include thinning and possibly salvage of trees previously killed by bark beetles. These management actions would probably not have a bearing on the fate of stands within the Little Canyon Mountain planning area. An exception to that statement could arise if adjoining land managers choose to carry out thinning treatments and leave slash in their stands at the improper time of year (between January and June). Material left in the woods between January and June could provide habitat for pine engraver beetles which could subsequently increase in number and provide an additional threat to nearby stands in LCM once the emerging beetles fly from that material in search of new hosts to colonize.

Environmental Effects of No Management Action

Direct Effects on Resource (1 year, 5 years & 10 years)

Much of the tree mortality has occurred in the past two years and the population of bark beetles is building up in the area. As such, additional trees are very likely to be infested and killed next year and in subsequent years until the current drought period ends. It is difficult to predict how many trees are likely to die, but an additional loss of two to four times the current level of tree mortality would not be surprising.

Indirect Affects on Resource (1 year, 5 years & 10 years)

The "thinning" effect produced by the bark beetle infestation will create openings in the stand that will provide some diversity and will cause the release of understory shrubs and non-host trees (Douglas-fir).

There has been and will continue to be a significant increase in dead fuels resulting from the bark beetle-caused mortality. Dead trees can be expected to remain standing for about ten years, on average, and over time there will be an increase in down wood.

Brief summary of impacts of No Management Action

If no thinning treatments are carried out, there will be additional mortality in the ponderosa pine component of these stands. Although it is not possible to predict accurately how extensive this mortality will be, it would not be surprising to see a four-fold increase above the mortality that has already occurred. Many of the trees that die are likely to be the largest trees in the stand, given that some of the recent mortality has included trees of large diameter.

Comparison of Alternatives

The threshold basal area that constitutes the "Upper Management Zone" for the LCM stands is 100 square feet per acre, as determined from stand examinations that included measurements of the recent radial growth of codominant trees (R. Vidourek, personal communication). Stands with stocking densities above this level can be considered susceptible to infestation by bark beetles. Treated stands where the residual basal areas are below the UMZ of 100 square feet of basal area per acre are far less likely to experience mortality from bark beetles. As such, the degree to which the alternatives address the hazard reduction to bark beetles is a function of the number of treated acres where the residual basal area is brought below 100 square feet per acre. Alternatives C through E would all reduce the hazard to bark beetles by a substantial degree, and any of them should provide a mosaic of stand conditions where bark beetle activity would be within be endemic levels, consistent with a more natural setting than the one that exists today. Alternative B, by limiting the treatable acres to 225, and by setting a size limit on the trees to be removed, does very little to reduce stand vulnerability to bark beetle depredation. From the perspective of minimizing bark beetle populations, reductions in basal area that are far below the UMZ are not necessarily better than lesser reductions, although the more extreme treatments would allow more time to pass before the stands once again grow into a susceptible state. Alternatives C and F would each leave about 10% of the area at stocking densities above the UMZ and hence susceptible to bark beetles. From a landscape perspective, this is a small portion of susceptible stand condition, and should not impair the attainment of the management objectives for the project area. Instead, having a small residual portion of susceptible stand condition in Alternatives C and F will provide a source of horizontal diversity in the LCM area where new snags will naturally occur and where foraging opportunities will be provided for woodpeckers. Alternatives D and E would provide even less habitat for bark beetles and their predators that the other alternatives.

Environmental Effects of Management Alternatives

<u>Direct Effects on Resource</u> (1 year, 5 years, 10 years)

Regardless of the alternative that is selected, it is important to be aware that there may still be some additional tree mortality occurring in the short term. Even though dead and dying trees are being targeted for removal in most of the action alternatives, some currently infested trees may be missed and may later discolor, giving the impression that trees continue to die in spite of the treatment. In addition, many of the residual trees remaining after treatment will have poor crowns and will require some time before they experience the benefits of thinning and before they can build resistance to bark beetle attack. During this time of vulnerability, some of these trees may be infested and may die from beetles coming from the immediate or surrounding areas. In areas where a very aggressive treatment is proposed (e.g., Alternatives C and F, with residual basal areas of 0-40 square feet per acre on 1300 and 352 acres, respectively), there may be even less basal area remaining after treatment than expected. If tree cover is important on those treated acres, it may be advisable to target the higher end of the proposed residual basal area ranges in order to compensate for some unexpected tree mortality.

Within five or ten years, the surviving residual trees should have sufficient resources to grow and be resistant to bark beetles as long as their basal areas remain below the threshold of 100 square feet per acre.

<u>Indirect Effects on Resource</u> (1 year, 5 years, 10 years)

<u>Possible Design Criteria or Mitigation measures that could be used to reduce impacts to resource</u>

Bark beetles are opportunistic and depend on reduced host vigor in order to be successful. As such, the effects of bark beetles are very readily managed through stand tending treatments that reduce stocking levels and that promote better tree growth in the residual stand. The standard stocking level reduction to be applied is addressed in Cochran (1992) and Cochran and others (1994). In these publications the authors describe an "Upper Management Zone" (UMZ), a level of stocking above which density-related tree mortality is likely to occur. The UMZ for a particular stand is linked to the productivity or long-term carrying capacity of the site and can be determined by extracting growth cores from codominant trees. Growth rates of these trees, when related to the existing stocking levels, will provide an index of the level of stand density reduction that is necessary to provide adequate resources for the residual stand. The UMZ described by Cochran calls for a stocking level at which codominant trees will be able to produce 13 or fewer rings per inch of radial increment. A stocking level below the UMZ will provide for vigorous tree growth and will dramatically reduce tree susceptibility all of the pine bark beetles in the area.

An important consideration for the management of pine engraver populations is to insure that habitat is not created for them in the process of thinning stands. The pine engraver prefers down material such as slash, and can build large populations in this material to later infest standing trees. The guidelines for timing of thinning operations call for avoiding slash creation between the months of January and June (Livingston 1979).

It is important to recognize that treating a stand under infestation by bark beetles poses some significant challenges. There are all levels of tree damage to be recognized in such a stand: trees with dead tops and brown foliage that are still alive, trees recently dead with brown crowns, trees dead but with green crowns, and trees with green crowns that have been top-killed. The latter two cases will be common in an area such as LCM and will require that marking crews look for telltale signs such as boring dust and pitch tubes associated with bark beetles. The presence of woodpecker feeding may also provide a clue that trees with green crowns have actually been infested and killed even though they appear to be alive from the appearance of their crown. Even if the goal of a treatment is to remove all dead trees, some will be missed and will only discolor after the treatment has been carried out. There will also be a "lag period" between the thinning treatment and the vigor response by the residual trees, which will lead to some additional tree loss even after the treatment has been carried out.

References

Cochran, P. H. 1992. Stocking levels and underlying assumptions for uneven-aged ponderosa pine stands. USDA Forest Service, Pacific Northwest Research Station, Research Note PNW-RN-509. 10 p.

Cochran, P. H.; Geist, J. M.; Clemens, D. L.; Clausnitzer, R. R.; Powell, D. C. 1994. Suggested stocking levels for forest stands in northeastern Oregon and southeastern Washington. USDA Forest Service, Pacific Northwest Research Station, Research Note

PNW-RN-513. 21 p.

Both of these references represent work that has been done in the Pacific Northwest Region, based on local plant communities. They are also the most recent publications available for managing the stocking levels for conifer stands in the region.

Livingston, R. L. 1979. The pine engraver, *Ips pini* (Say) in Idaho. Life history, habits and management recommendations. Idaho Department of Lands, Forest Insect and Disease Control. Coeur d'Alene, Idaho. Report 79-3. 7 p.

This report describes the management practices necessary to limit populations of the pine engraver and although written for Idaho, has relevance for Oregon as well.